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(54) Currency handling apparatus

(57) A currency handling apparatus for dispensing currency units from a plurality of stores, each for storing units of currency of a respective denomination, comprises means for predicting the future distribution of currency units to be dispensed and means for outputting a signal representing instructions for changes to the stores in accordance with the predicted future distribution.

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Description

[0001] This invention relates to apparatus for handling units of currency. The invention will be described mainly in the context of coin handling, but is also applicable to apparatus which also or alternatively handles other units of currency, such as banknotes, smart cards, payment cards or the like.

[0002] It is known to provide a coin handling apparatus which receives and validates coins of different denominations, and directs valid coins to respective containers each containing coins of a single denomination. It is also known to dispense coins from these containers as change in an amount corresponding to the difference between the value of inserted coins and the price of a product or service obtained from a machine associated with the coin handling apparatus.

[0003] It is also known to arrange for the level of coins in each container not to exceed a predetermined upper level. The apparatus would thus tend to direct coins of a particular denomination to art associated container until the upper level is reached, and then any further coins of the same denomination would be sent to a cashbox, which would normally be of a type which does not permit the dispensing of coins therefrom.

[0004] Periodically, an operator will empty the cashbox. At this time, it is common for operators to adjust the levels of coins in the coin containers so that each one will contain a number of coins corresponding to a so called "float" level for the respective container in an attempt to ensure that there is usually an adequate supply of coins in the container to be used as change if this is necessary.

[0005] In use, between visits by the operator, the levels of coins in the containers vary, and at some times there may not be sufficient coins in a container to supply the correct change for a given transaction, when the machine is said to be in "exact change only" mode. It is understood that when a vending machine only accepts the exact change for a selected item, sales are lost.

[0006] It is known from EP 0 653 084 (the contents of which are incorporated herein by reference) to attempt to minimise the risk that. in the period following servicing of the machine, there will be insufficient coins available for change by arranging for the apparatus to monitor certain parameters, to calculate dynamically the likelihood that a particular denomination will be required for dispensing.

[0007] Accordingly, the invention provides a currency handling apparatus for dispensing currency units from a plurality of stores, each for storing units of currency of a respective denomination, comprising means for predicting the future distribution of currency units to be dispensed and means for outputting a signal representing instructions for changes to the stores in accordance with the predicted future distribution.

[0008] The invention also provides a currency handling apparatus comprising a plurality of stores each for storing units of currency of a respective denomination, means for dispensing currency units from the stores, and means for predicting the distribution of currency units to be dispensed, wherein the number of stores for a given denomination is selected in accordance with the predicted distribution. For a particular coin mechanism, the currency stores are manufactured with a predetermined capacity, which limits the amount of currency available for change. By providing multiple stores for a given denomination, where it is judged desirable by the predicting means, it is possible to reduce the occurrence of events when there are insufficient coins available for change without the need for expensive alteration of the coin mechanism.

[0009] Preferably, the apparatus comprises means for monitoring certain parameters over time, and the information so obtained is used by the predicting means.

[0010] The parameters may include data indicative of the relative populations of currency of different denominations, either throughout the country in which the apparatus is being used or in a local region in which the apparatus is used. Denominations which are more numerous will be more likely to be inserted into the apparatus and less likely to be needed in large quantities as change in the period immediately after servicing the machine.

[0011] The parameters may also take into account the prices of products vended or services performed in exchange for cash received by the apparatus. If for example the price of a product is slightly less than a unit of currency, there is a substantial likelihood that the apparatus will be required to pay out the difference in change. The parameters may also take into account the relative demand for different products or services, for example, by considering past sales.

[0012] As a more direct indication of the likely need for change, the parameters may include data representing the rate at which currency units are received by the machine and/or the rate at which currency units are dispensed by the machine. The difference between these two numbers for a particular denomination indicates whether currency of that denomination are likely to be dispensed from or delivered to the respective store.

[0013] The parameters may additionally or alternatively relate to the way in which currency units of a particular denomination have been handled. e.g. whether they have been predominantly routed to the cashbox or to a store. This will vary depending upon whether the store is tending either to stay full or to be frequently depleted by providing change.

[0014] Thus, a preferred embodiment may be arranged to use any one or more of the following parameters:

(a) data indicative of the relative population levels of respective currency denominations in the area in which the apparatus is to be used;

(b) the number of currency units of a particular d nomination which have been received by the apparatus;

(c) the number of currency units of a particular denomination which have been dispensed by the apparatus;

(d) the way in which currency units of a particular denomination have been routed by the apparatus;

(e) the or each denomination which can be dispensed by the apparatus; and

(f) price data representative of the price of products or services obtained by supplying currency units to said apparatus.

[0015] It will be noted that these parameters are interrelated. Other monitorable parameters bearing a direct or indirect relationship to one or more of these parameters may be used.

[0016] The invention also provides a method of operating a currency handling apparatus comprising predicting the future distribution of currency units to be dispensed and providing a plurality of stores, each for storing units of currency of a respective denomination, and outputting a signal representing instructions for changes to the stores in accordance with the predicted future distribution.

[0017] The invention further provides a currency handling apparatus comprising storage means for storing currency to be dispensed as change and recording means for recording details of an event when there is insufficient currency in the storage means to supply the correct change for a given transaction.

[0018] An example of an apparatus in accordance with the invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 is a schematic diagram of the mechanical part of a coin handling apparatus;

Fig. 2 is a block diagram of the circuit of the coin handling apparatus;

Fig. 3 is a diagram showing a removable cassette;

Fig. 4 is a flow diagram;

Fig. 5 is a diagram of a vending machine;

Fig. 6 is a flow chart; and

Fig. 7 is a flow chart.

[0019] Fig. 5 shows a vending machine, indicated generally by the reference number 90. Referring to Fig. 1, the coin handling apparatus 2 in the vending machine includes a coin validator 4 for receiving coins as indicated at 6. During the passage of the coins 6 along a path 8 in the validator 4, the validator provides signals indicating whether the coins are acceptable, and if so the denomination of the coins. Various types of validators are known, including validators using optical, acoustic and inductive techniques. Examples of such validators are described in, amongst others, GB 1 397 083, GB 1 443 934, GB 2 254 948 and GB 2 094 008, the contents of which documents are incorporated herein by reference.

[0020] Acceptable coins then enter a coin separator 10, which has a number of gates (not shown) controlled by the circuitry of the apparatus for selectively diverting the coins from a main path 12 into any of a number of further paths 14, 15, 16 and 17, or allowing the coins to proceed along the path 12 to a path 20 leading to a cashbox 21. If the coins are unacceptable, instead of entering the separator 10 they are led straight to a reject slot via a path 30.

[0021] Each of the paths 14, 15, 16 and 17 leads to a respective one of four coin tubes or containers 22, 24 and 26 and 28. Each of these containers is arranged to store a vertical stack of coins of a particular denomination. Although only four containers are shown, any number may be provided.

[0022] A dispenser indicated schematically at 29 is operable to dispense coins from the containers when change is to be given by the apparatus. The dispensed coins are delivered to a refund path 31.

[0023] As shown in Fig. 3, the tubes 22, 24, 26, 28 are provided in a removable cassette 40, and the tubes themselves are removable from the cassette, as described in GB 2 246 897 A, the contents of which are incorporated herein by reference.

[0024] Referring to Fig. 2, the circuit of the present embodiment of the invention incorporates a microprocessor 50 connected to data and address buses 52 and 54. Although separate buses are shown, data and address signals could instead be multiplexed on a single bus. A bus for control signals could also be provided.

[0025] The microprocessor 50 is connected via the buses 52 and 54 to a read-only memory (ROM) 56 and a random access memory (RAM) 58. The ROM 56 stores the program controlling the overall operation of the microprocessor 50, and the RAM 58 is used by the microprocessor 50 as a scratch-pad memory.

[0026] The microprocessor 50, the ROM 56 and the RAM 58 are, in the preferred embodiment, combined on a single integrated circuit.

[0027] The microprocessor 50 may also be connected via the buses 52 and 54 to an EAROM 60 for storing a variety of alterable parameters.

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[0028] The microprocessor 50 is also coupled via the buses 52 and 54 to input/output circuitry indicated at 62. The circuitry 62 includes user-operable switches, at least one level sensor for each of the coin containers 22, 24, 26, 28, circuits for operating the dispenser 29 and the gates of the coin separator 10, the circuitry of the coin validator 4, and a display visible to a user of the apparatus for displaying an accumulated credit value and an indication when insufficient coins are stored to guarantee that chance will be available. The circuitry 62 is connected to a display 68 visible to the operator, and to a keypad 70 accessible only to the operator.

[0029] The input/output circuitry 62 also includes an interface between the control circuit of the apparatus and a vending machine circuit board 64 to which it is connected, and a further interface to an audit device 66.

[0030] In operation of the apparatus the microprocessor 50 successively tests the signals from the validator to determine whether a coin has been inserted in the apparatus. When a credit has been accumulated, the microprocessor also tests signals from the vending machine to determine whether a vending operation has been carried out. In response to various signals received by the microprocessor 50, various parts of the program stored in the ROM 56 are carried out. The microprocessor is thus arranged to operate and receive signals from the level sensors of the coin containers 22, 24, 26, 28, and to control the gates in the separator 10 in order to deliver the coins to the required locations, and is also operable to cause appropriate information to be shown on the displays of the apparatus and to deliver signals to the vending machine to permit or prevent vending operations. The microprocessor is also operable to control the dispenser to deliver appropriate amounts of change.

[0031] The arrangement so far is quite conventional, and the details of particular structures suitable for using as various parts of the mechanism will therefore not be described in detail.

[0032] The particular sequence of most of the operations carried out by the microprocessor may be the same as in previous apparatus. A suitable program to be stored in the ROM 56 can therefore be designed by anyone familiar with the art, and accordingly only the operations carried out by the particularly relevant parts of this program will be described.

[0033] The apparatus 2 is arranged to monitor each transaction performed by the vending machine. More specifically, the microprocessor 50 registers, for each transaction, the price of the item selected, the number and denominations of the coins supplied as payment, and the number and denominations of coins supplied in change. The processor 50 also registers when 'exact change only' events occur, and which coin tubes are empty and for how long. The number and denomination of coins supplied as change is determined by a suitable change algorithm in the microprocessor, as described, for example, in GB 2 269 258, the contents of which are incorporated herein by reference. The information registered by the processor 50 is stored in the audit device 66.

[0034] When the operator visits the machine, he causes the microprocessor 50 to analyse data stored by the audit device 66 and calculate a desired float level for each denomination of coin by pressing appropriate keys on the keypad 70. Alternatively, the stored data can be downloaded to and processed by a computer which the operator plugs into the processor 50 or the audit device 66. Steps of the calculation are set out in Fig. 4. More specifically, the microprocessor 50 calculates the total number of coins of that denomination that have been inserted (step 72) and the total number of coins of that denomination (step 74) that have been dispensed in the previous seven days. The difference between the number of coins dispensed and inserted is then calculated (step 76). That number is then multiplied by four, assuming that the operator visits the machine once a month, to arrive at an estimate for the difference over a month, and hence an estimate for the float level. The microprocessor 50 then divides that estimated figure for the float level by the maximum number of coins that can be stored by a tube in the mechanism (step 78), rounds up the result (step 80) to the next whole number to arrive at a number which represents the number of tubes of that denomination that should be supplied.

[0035] The microprocessor 50 performs similar calculations for each denomination of coin, and then decides what changes need to be made to the coin tubes in the assembly at the time. A signal, representing instructions regarding changes to the tubes, is generated and sent to the circuitry 62. The instructions are then displayed on the display 68.

[0036] For example, suppose over a period of 7 days, the coin mechanism detects that 100 5p coins are inserted, and 130 5p coins are dispensed as change. If the operator is to visit the machine once a month, using steps of the algorithm set out above it is estimated a float of 120 5p coins should be available at the start. Assuming that a preformed tube stores at most 90 5p coins, then it can be seen that at least two such tubes, each full of 90 5p coins should be present at each service to reduce the risk that an exact change only mode will occur. Instead of supplying two full tubes, two tubes containing a total of 120 or more coins could be provided.

[0037] In the example given above, the processor 50 is making predictions about the tubes to be required by predicting the likely distribution of coins to be dispensed as change. This is done by monitoring the flow in and out of each denomination coin over a predetermined period of time, or, more simply, the difference between the number of coins of that denomination inserted and the number dispensed. The number of tubes to be required is then estimated using the predetermined, known capacity of a tube.

[0038] The above example does not, for example, take account of fluctuations throughout the seven day monitoring period, such as periods when a sequence of 5ps are dispensed as change, but none are inserted. More sophisticated

methods of predicting a good float level and hence the number of tubes required are possible.

[0039] In an alternative approach, a rate of depletion for each coin denomination is calculated, where

$$\text{Rate (R)} = \frac{\text{(no. of coins dispensed - no. of coins accepted)}}{\text{capacity of coin tube(s)}}$$

(taking into account only coins of the given denomination).

[0040] The rate is established over 50 vends, and is then continuously updated, using a running sample of 50 vends in a sequence.

[0041] R tends to 0 with a slower depletion of coins in the coin tubes and tends to 1 with a faster depletion of coins. The calculated value R can be used as an indicator for changes in the tubes. For example, if $R > 0.80$ for a given denomination continuously for a certain number of vends, say 10, then the microprocessor outputs a signal indicating that the number of coin tubes for that denomination should be increased. Similarly, if $R < 0.15$, for example, the processor outputs a signal indicating that the number of tubes should be decreased (the processor can be programmed to suppress such a signal if the number of tubes is one).

[0042] The information about the number and denomination of coins inserted into the mechanism and monitored by the microprocessor 50 is useful on its own. For example, it can give an indication of changes in the relative population levels of certain denominations of coins, or of the introduction of new coins into a coin set.

[0043] As discussed below, predictions for the number of tubes of each denomination to be provided can be made in other embodiments of the invention in ways and using variables other than those in the examples above.

[0044] Information about the prices of items for sale is useful for making accurate predictions of change that will be necessary. Price information is especially useful in such predictions when there is an alteration in price. As an illustration only, suppose the vending machine is set up for use in the U.K. and comprises a single coin tube for each of 5p, 10p, 20p, and £1. Only one item is available for sale and its price is 95p. Using the information about the price of the item for sale and of the acceptable currency set, the processor can work out that, whatever coins are inserted, the only change that will ever be dispensed are 5ps and 10ps. On that basis, the processor issues instructions to remove the 20p, and £1 tubes and replace them with, for example, one extra tube for 5ps, and one extra tube for 10ps, and direct all the remaining coins straight to the cash box.

[0045] Another useful parameter is the number and denominations of coins dispensed as chance. Such information can be used in another embodiment, for example, to request a new tube for coins of a higher denomination than any already provided. Suppose the highest denomination of coin for which a tube is provided is a 20p coin and transactions occur regularly (say more than 5 times a day an average) where five or more 20p coins are dispensed as chance, then a £1 coin tube may be requested. Usually, it will be preferable also to consider other parameters as well, such as number of denominations of coins inserted. In the above example, a £1 coin tube would be of limited use if few £1 coins are received because the tube would empty relatively rapidly. The change algorithm in use, which influences the likelihood that a coin will be dispensed in change, may also be useful.

[0046] Other parameters, such as data indicative of the relative population levels of respective currency denominations in the area in which the apparatus is to be used, may be relevant. The relative population level of given denominations are related to the probability that those denominations will be inserted into the machine. The relative population levels may vary within a country, as, for example, in Southern Germany where there is a different distribution of coins from the rest of the country. Such data is known, and can be supplied by a programming mechanism such as a computer, in the field, or it may be pre-programmed in, depending on the intended destination of the mechanism. The mechanism might, for example, note where the use of smart cards and/or banknotes is on the increase and recommend changes in the coin tubes as a result. As mentioned above, a record is made regarding 'exact change only' events. It is noted, for example, when exact change only events occur, how long they last, and which tubes have been emptied (or have a level provided). Some or all of that information can also be used in predicting what change tubes should be provided.

[0047] While each of the parameters mentioned above may be used on its own in an embodiment of the invention to provide an indication of change tubes to be required, it is usually advantageous to consider two or more of those parameters in combination.

[0048] In the present example, the change cassettes comprise removable tubes 22, 24, 26, 28. The operator simply interchanges tubes of certain denominations in accordance with the instructions on the display means 68. The operator uses the keypad 70 on the coin apparatus to inform the microprocessor of the changes in the tubes in the mechanism, which alters the settings in the microprocessor 50 accordingly so that coins are subsequently directed to and dispensed from the correct tube.

[0049] Other modifications to the apparatus described are also envisaged. For example, instead of using the information stored in the previous seven days, the microprocessor may analyse the information stored since the apparatus

was installed. Alternatively, for example, the processor could be arranged to carry out an analysis of the relevant information after a predetermined number of transactions.

[0050] Instead of replacing certain tubes, the operator could replace the whole cassette, in accordance with suitable instructions from the apparatus, with a cassette prepared with a predetermined arrangement of tubes. Cassettes prepared in such a way may be marked with a code, indicating the type and distribution of tubes within the cassette, so that instructions for changing the tubes can be displayed using the appropriate code, and once the cassette is inserted, the code can be input via the keypad to inform the microprocessor of which tubes are in use.

[0051] The prediction may be stored in the processor to be retrieved by the operator at a later date. Alternatively, predictions may be obtained remotely, using known techniques, so that the operator knows in advance what tubes to take to the machine to service it. For example, the machine may transmit signals down a telephone line, or mains line, to a computer in the servicing centre. The transmitted signals may be data relating to the vend signals, which are then processed at the servicing centre to provide instructions about changing the tubes, or signals representing the instructions. Data can also be downloaded using a smart card and processed or read elsewhere.

[0052] The information regarding 'exact change only' events, that is recorded in the audit device has uses other than for predicting change tubes to be required. As mentioned previously, an exact change only event is deemed equivalent to lost sales, and a record of such events is useful for analysts to determine the occurrence and volume of lost sales. A log of exact change only events can also be useful in setting float levels, or for determining whether the operator needs to visit the machine more often to replenish the coin tubes.

[0053] In the example given above, the rate at which the service operator visits the machine or the next date for a visit is predetermined and the visiting rate or date is used in working out the optimum number of stores for reducing the risk of one or more tubes running out of coins. Alternatively, as described in more detail below, the operator may visit the vending machine to replace the change cassette or replenish the stores in response to instructions which are output from the machine in advance, for example, instructions regarding a date on which a visit should be made.

[0054] In this example, the machine outputs instructions for the operator to visit in accordance with a prediction of when one of the tubes is likely to run out of coins.

[0055] To make the prediction, the processor 50, automatically and once a week, performs certain calculations, as explained below with reference to Fig. 6, using information stored in the audit device 60.

[0056] First, the processor 50 calculates, for one of the denominations used for change, a rate of depletion r_l for the preceding week, as follows:

$$r_l = b_l - a_l$$

where b_l = no. of coins of the given denomination dispensed as change in the preceding week, and a_1 = no. of coins of the given denomination inserted as payment in the preceding week.

[0057] The number of coins in the tubes for the relevant denomination at the time at which the calculations are being carried out, N_l, is divided by r_l, and the result rounded down to the nearest whole number. V_l. The number V_l is an estimate of the number of weeks before the tube will empty.

[0058] The above calculations are repeated for each of the denominations used for change, to result in a set of values V_i. The smallest non-negative value V_S, which is the shortest time before one of the tubes is estimated to run out of coins, is selected.

[0059] The processor then informs the service centre, via a telephone connection, that the operator needs to visit the machine on a date in V_S weeks time. On that visit, the operator replaces the change cassette with a new change cassette, already containing coins at appropriate, predetermined levels.

[0060] Various modifications to the above-mentioned embodiment are also envisaged. Instead of simply informing the operator of a date on which to visit, the machine can also calculate and output the likely number of coins to be held in each of the stores in V_S weeks time so that the operator knows how many coins of each denomination to bring to replenish all the stores. The calculations may be performed at other rates, for example, daily, or once a month. Predictions can be made using other parameters, for example, those described above in relation to the first example, or using other calculations. Instead of calculating when the first tube is likely to empty, the processor may instead predict when a tube is likely to have a given number of coins, for example, two. In the calculation of the date when the operator should visit, a margin of error of, say, a week, may be introduced (that is, the operator is instructed to visit a week before the date on which the processor has estimated that the first tube will run out of coins). As before, the data could be supplied remotely with the calculations being performed remote from the vending machine.

[0061] In another example, instead of requesting a change to the tubes, the mechanism reallocates an existing tube and uses it for a new denomination of coin.

[0062] In this example, the vending machine is set up for use in Brazil. Thus, the acceptance criteria within the validator for determining which coins are acceptable correspond to Brazilian currency and the tubes are configured to store coins of Brazilian currency.

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before and so on up to n=6 for the last day in the preceding week. Thus if today is Tuesday, then n=0 refers to Monday, n=1 refers to Sunday, etc., and so on up to n=6, referring to Wednesday. Similarly, if today is Wednesday, n=0 refers to Tuesday, etc. F and f are fade factors, representing the fact that, as time passes, information about a day's activity plays a smaller part in predictions. F is the fade factor per week and f is the fade factor per day. In this example, $(1-f)^7 = (1-F)$, and more particularly, F = 0.5.

[0078] The variables A_n and x_n are used, where A_n is the average sales for product A for day type n, relative to the running average over all days for all products, and x_n is the running average daily total sales for all products as calculated on day n. Instead of calculating the averages using all data collected from when the vending machine first started operating, which would require a large amount of memory, the averages are calculated at the end of each day using algorithms, as set out below:

$$A_{current} = A_6(1-F) + Ft_A/x_0$$

where t_A = total number of sales for product A for the day just ended.

$$x_{current} = x_0(1-f) + fT$$

where T is the total number of sales for all product types for the day just ended.

[0079] Now, a value W is calculated where $W = x_{current}/x_6$. Thus, W represents the running avenge just calculated relative to the same running average as calculated on the same day the previous week. If W is less than 1, then it is changed to 1 for calculating stock requirements, because an increase in stock requirements is the main interest.

[0080] Another variable R_n is also calculated, where R_n is the average total sales for a particular day type (eg Monday), relative to the running average over all days as calculated the previous day.

$$R_{current} = R_6(1-F) + FT/x_0$$

[0081] Also a vanance term V_A is calculated where $V_A = (1-f)V_A + fD_A^2$

[0082] D_A is the difference between the actual total sales of product A for the day just ended and the expected total sales for product A for the day just ended.

[0083] Thus:

$$D_A = t_A - E_A$$

where t_A = total number of sales for product A for the day just ended and E_A = the expected total number of sales for product A for the day just ended. E_A is calculated by the equation

$$E_A = A_6x_0$$

where A_6 and x_0 are as already calculated at the end of the preceding day.

[0084] If D_A is negative, it is set to 0. This gives a different response to rises in product throughput compared with falls.

[0085] Having performed all the above calculations, the calculated values for x, A and R are renamed for use in subsequent calculations, that is calculations at the end of the day to come, and also for calculations of the general trend, discussed below. More specifically, x_6 is dropped, the values x_5 to X_0 are relabelled x_6 to x_0 respectively and $x_{current}$ is relabelled x_0. Similarly, A_6 and R_6 are dropped and $A_{current}$ and A_0 to A_5 are relabelled A_0 to A_6 respectively and $R_{current}$ and R_0 to R_5 are relabelled R_0 to R_6 respectively.

[0086] The general trend is then derived using these newly labelled values x_0 to x_6, and W as already calculated as set out above. The general trend is given by x_nW^m, where n is the day of the week, from n=0 to n=6, and m is the week number, starting at m=1 for the week to come. Thus, the general trend for the coming day is x_6W, for the following day it is x_5W and so on up to x_0W. The week after starts with x_6W^2, x_5W^2 and so on.

[0087] The general trend as set out above gives a broad indication of likely future sales. A respective variability component is also added for each product as an allowance for fluctuations.

[0088] The variability component for product A is the square root of (kdV_A)

where:

d = no. of days ahead for the prediction;
V_A is the variance term as calculated above; and
k is a constant.

[0089] In this example, k = 18, which has the effect of imposing an allowance similar in scale to three standard deviations for a normal distribution.

[0090] Other algorithms can be used to predict future product requirements. For example, a prediction for each type of product using only sales of the respective product is also possible. Also, for example, the calculations described above in relation to coins can be adapted for use with stock, the main difference being that new stock is not introduced at each end. In an alternative embodiment, a neural network is used to perform predictions of future stock requirements.

[0091] Various other modifications will be apparent to the person skilled in the art, and the invention is not limited to the specific examples described above.

Claims

1. A currency handling apparatus comprising a store for storing currency of a first denomination and signal generating means, wherein in response to a signal from the signal generating means the apparatus directs currency of a second denomination to the store.

2. A currency handling apparatus as claimed in claim 1 wherein the reallocation of the store is related to a change in currency sets.

3. A currency handling apparatus as claimed in any preceding claim wherein the reallocation of the store is related to a change in currency made available for change.

4. A currency handling apparatus as claimed in any preceding claim wherein the second denomination is a denomination that was previously directed to a cashbox of the currency handling apparatus.

5. A currency handling apparatus as claimed in any preceding claim wherein the second denomination is substantially the same shape and size as the first denomination.

6. A currency handling apparatus as claimed in any preceding claim wherein the apparatus continues to accept the first denomination when directing the second denomination to the store.

7. A currency handling apparatus as claimed in any preceding claim wherein the store is for dispensing currency as change.

8. A currency handling apparatus as claimed in any preceding claim comprising means for monitoring currency in the apparatus, wherein an output from the monitoring means influences the signal generating means.

9. A currency handling apparatus as claimed in claim 8 wherein the monitoring means monitors the depletion of currency from the store.

10. A currency handling apparatus as claimed in any preceding claim wherein a signal is generated when the rate at which currency is depleted from the store exceeds a predetermined value.

11. A currency handling apparatus as claimed in any preceding claim comprising means for monitoring certain parameters over time, wherein the information so obtained is used by the signal generating means.

12. A currency handling apparatus as claimed in any preceding claim wherein the signal generating means is responsive to data indicative of the relative population levels of respective currency denominations in the area in which the apparatus is to be used.

13. A currency handling apparatus as claimed in any preceding claim wherein the signal generating means is responsive to the number of currency units of a particular denomination which have been received by the apparatus.

14. A currency handling apparatus as claimed in any preceding claim wherein the signal generating means is responsive to the number of currency units of a particular denomination which have been dispensed by the apparatus.

15. A currency handling apparatus as claimed in any preceding claim wherein the signal generating means is responsive to the way in which currency units of a particular denomination have been routed by the apparatus.

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16. A currency handling apparatus as claimed in any preceding claim wherein the signal generating means is responsive to each denomination which can be dispensed by the apparatus.

17. A currency handling apparatus as claimed in any preceding claim wherein the signal generating means is responsive to price data representative of the price of products or services obtained by supplying currency units to said apparatus.

18. A currency handling apparatus as claimed in claim 17 wherein the price of products or services selected and the currency units supplied to obtain those products or services are monitored over time and the information so obtained is used by the signal generating means.

19. A currency handling apparatus as claimed in any one of claims 1 to 18 wherein the apparatus is for handling coins.

20. A currency handling apparatus as claimed in claim 19 wherein the currency stores are tubes arranged within a removable cassette.

21. A currency handling apparatus as claimed in claim 20 wherein the tubes are removable from the cassette.

22. A currency handling apparatus as claimed in any one of claims 1 to 21 comprising recording means for recording details of an event when there is insufficient currency in the stores to supply the correct change for a given transaction.

23. A currency handling apparatus as claimed in any one of claims 1 to 22 comprising means for counting the number of coins of each denomination inserted for each transaction.

24. A currency handling apparatus as claimed in any one of claims 1 to 23 comprising means for counting the number of coins of each denomination dispensed for each transaction.

25. A control board adapted for use in an apparatus according to any one of claims 1 to 24.

26. A processor adapted for use in an apparatus according to any one of claims 1 to 24.

27. A vending machine comprising a currency handling apparatus as claimed in any one of claims 1 to 24.

28. A method of operating a currency handling mechanism comprising a store for storing and dispensing currency in which initially only currency of a first denomination is directed to the store, and in response to a signal from the signal generating means currency of a second denomination is directed to the store.

29. A method as claimed in claim 28 wherein the reallocation of the store is related to a change in currency sets.

30. A method as claimed in claim 28 or claim 29 wherein the reallocation of the store is related to a change in currency made available for change.

31. A method as claimed in any one of claims 28 to 30 wherein the second denomination is a denomination that was previously directed to a cashbox of the currency handling apparatus.

32. A method as claimed in any one of claims 28 to 31 wherein the second denomination is substantially the same shape and size as the first denomination.

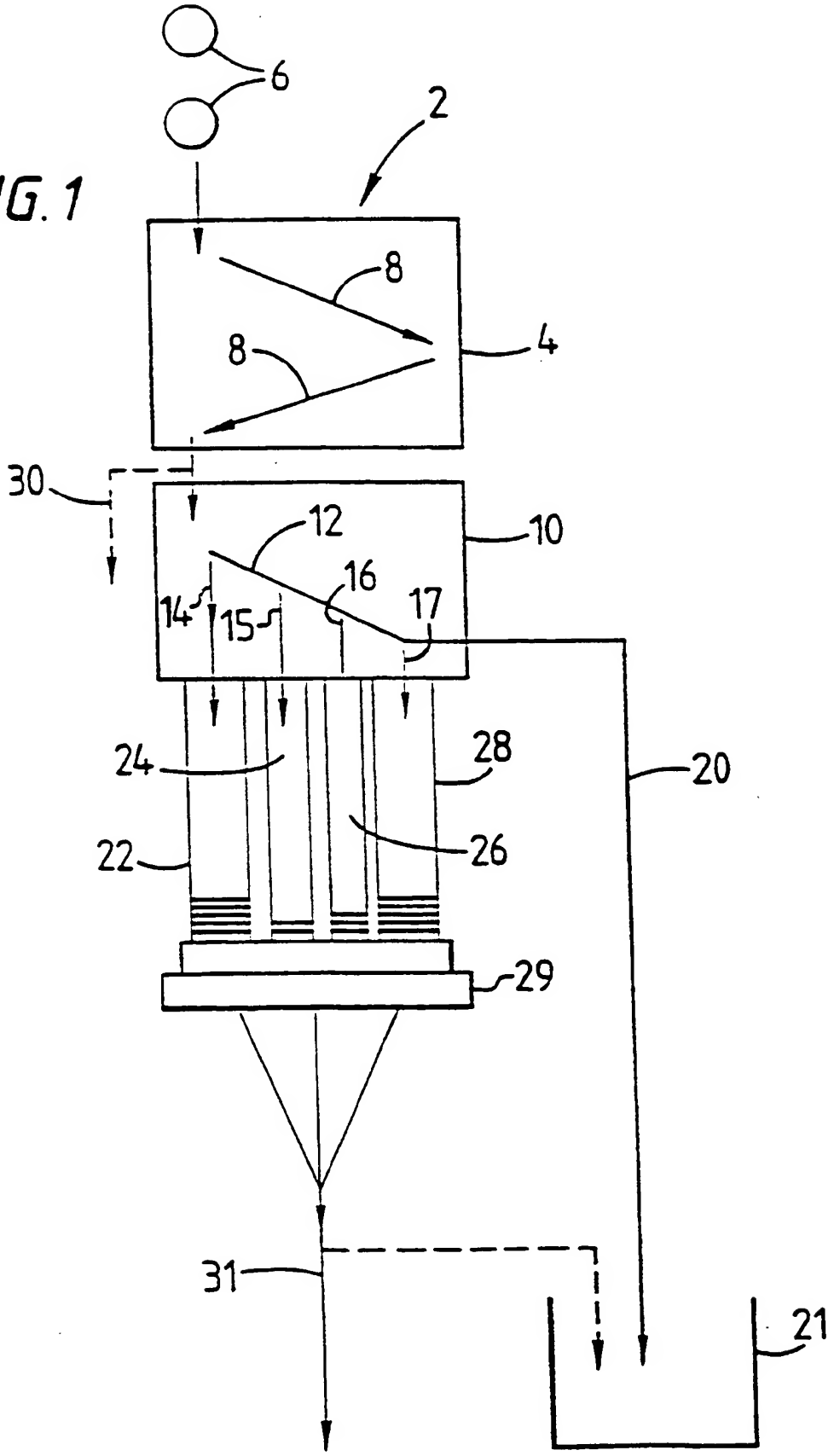
33. A method as claimed in any one of claims 28 to 32 wherein the apparatus continues to accept the first denomination when directing the second denomination to the store.

34. A method as claimed in any one of claims 28 to 33 in which the signal is generated in response to monitoring means which monitors the depletion of the currency of the first denomination from the store.

35. A method as claimed in any one of claims 28 to 34 in which all the currency of the first denomination is removed from the store in response to the signal.

36. A method as claimed in any one of claims 28 to 34 in which the mechanism continues to dispense currency of the first denomination in change after currency of the second denomination is directed to the store.

FIG. 1



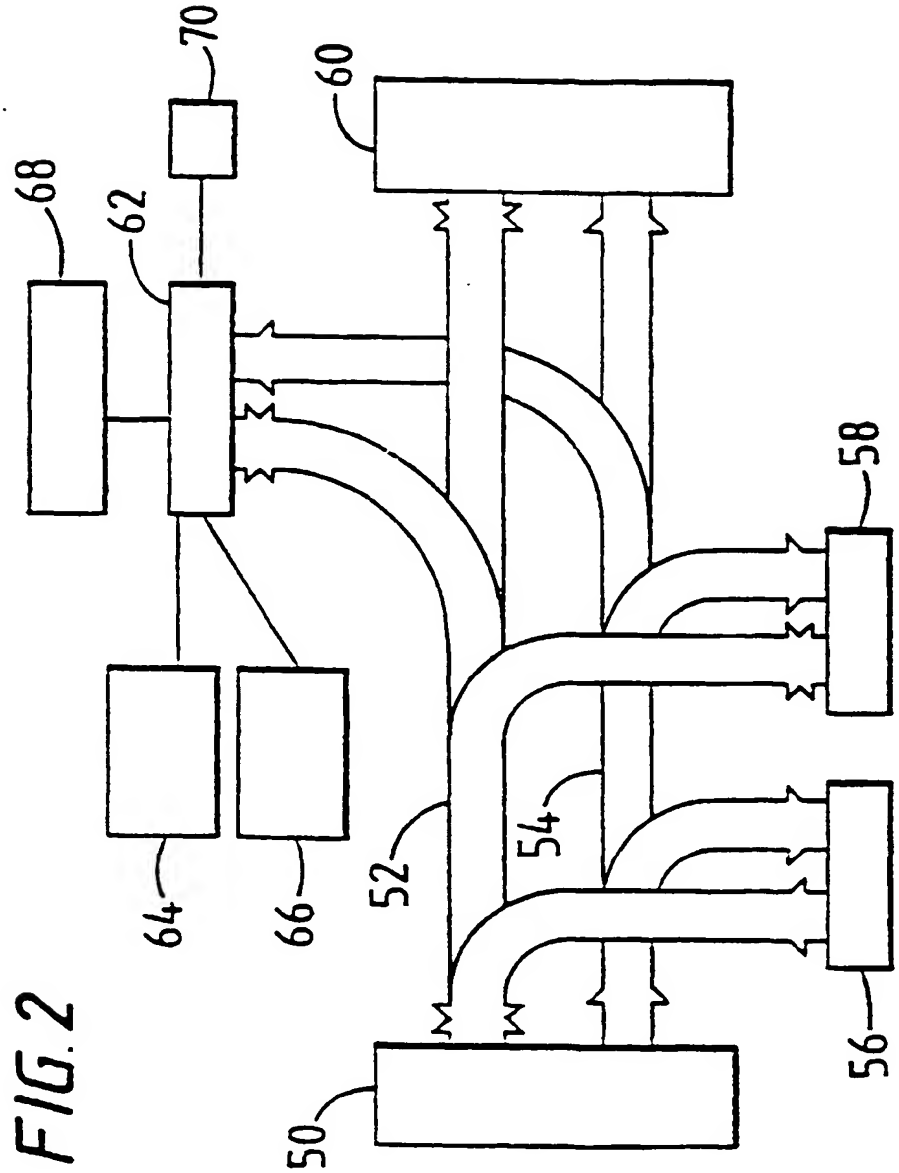


FIG. 2

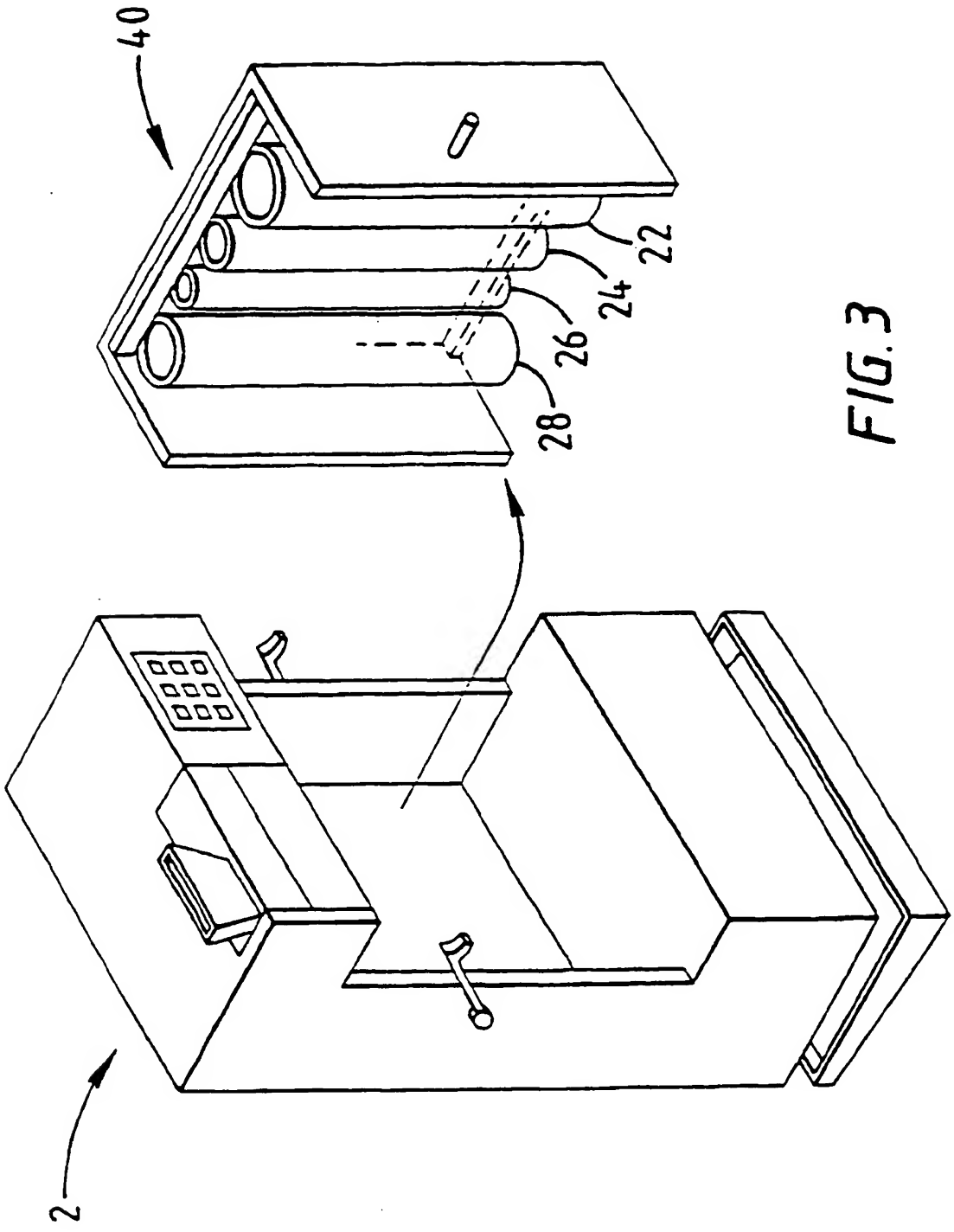


FIG. 3

FIG. 4

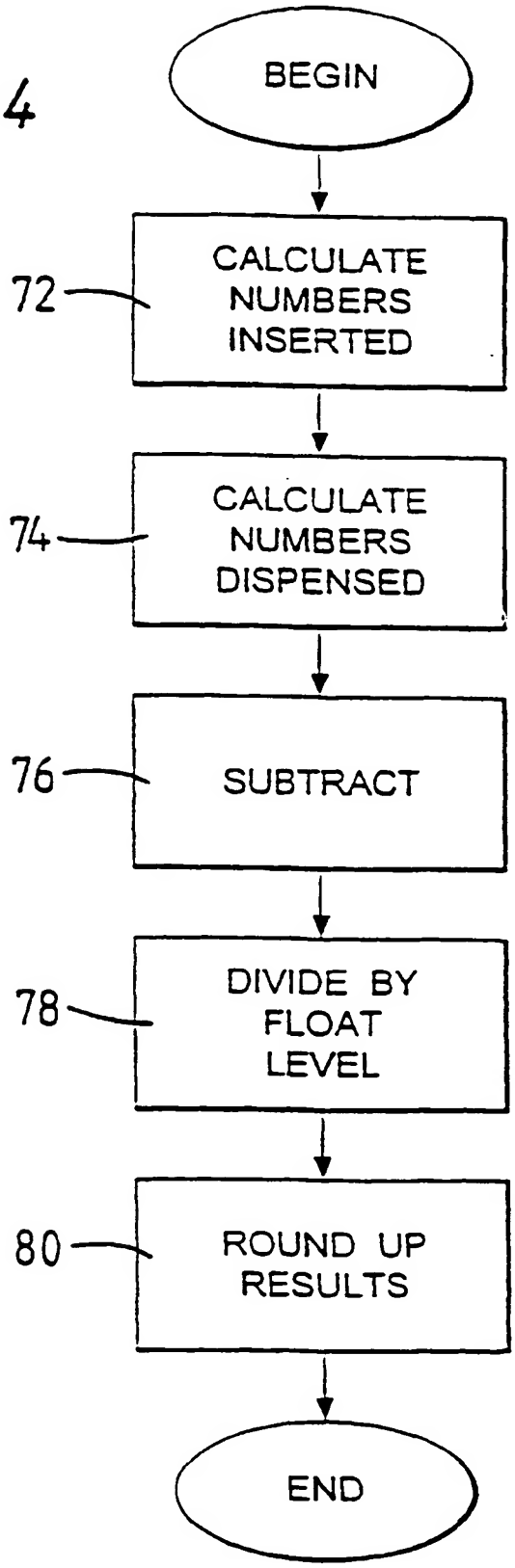


FIG. 5

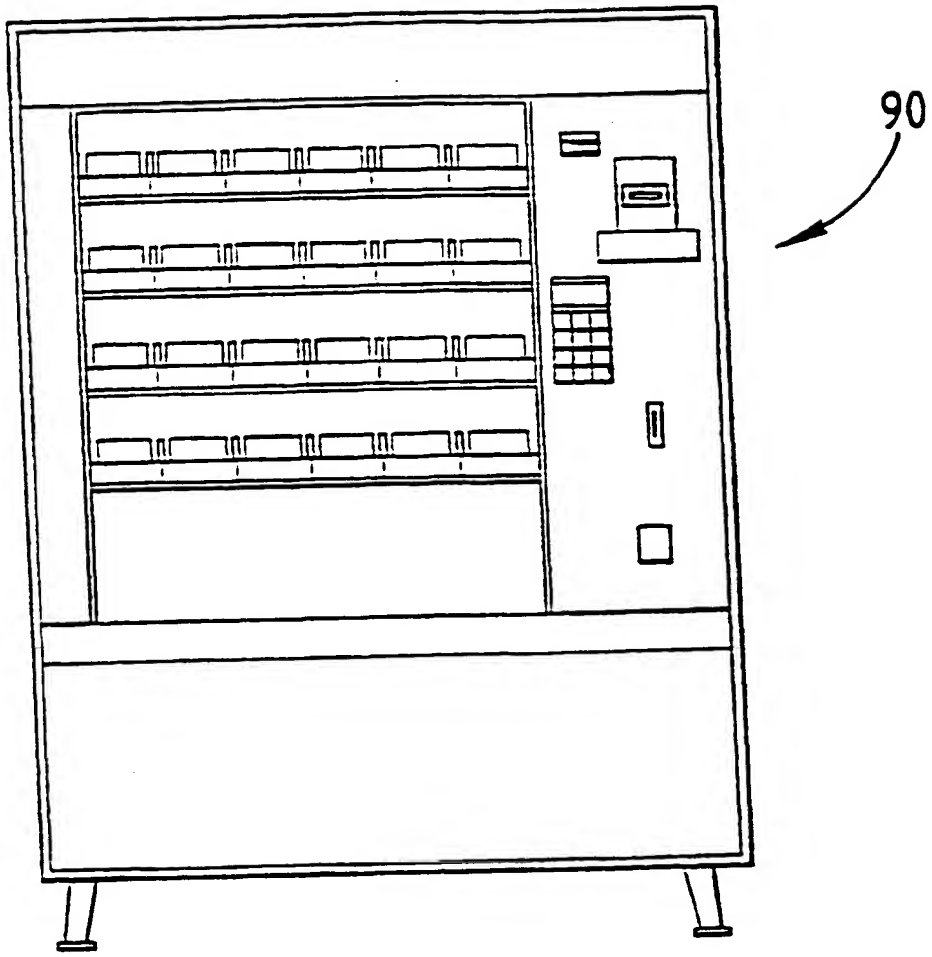


FIG.6

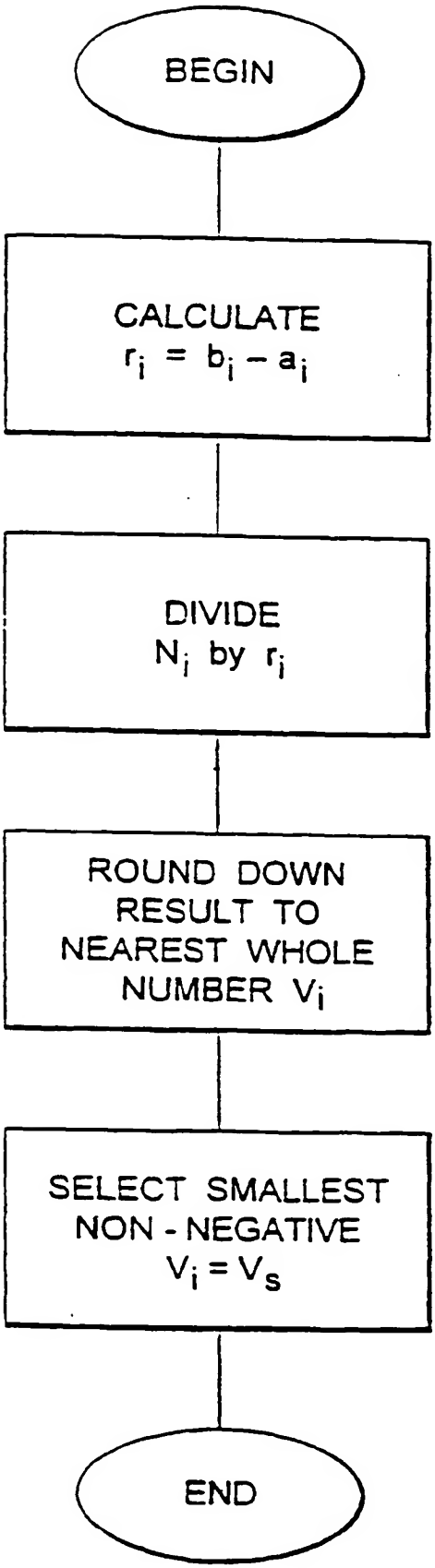
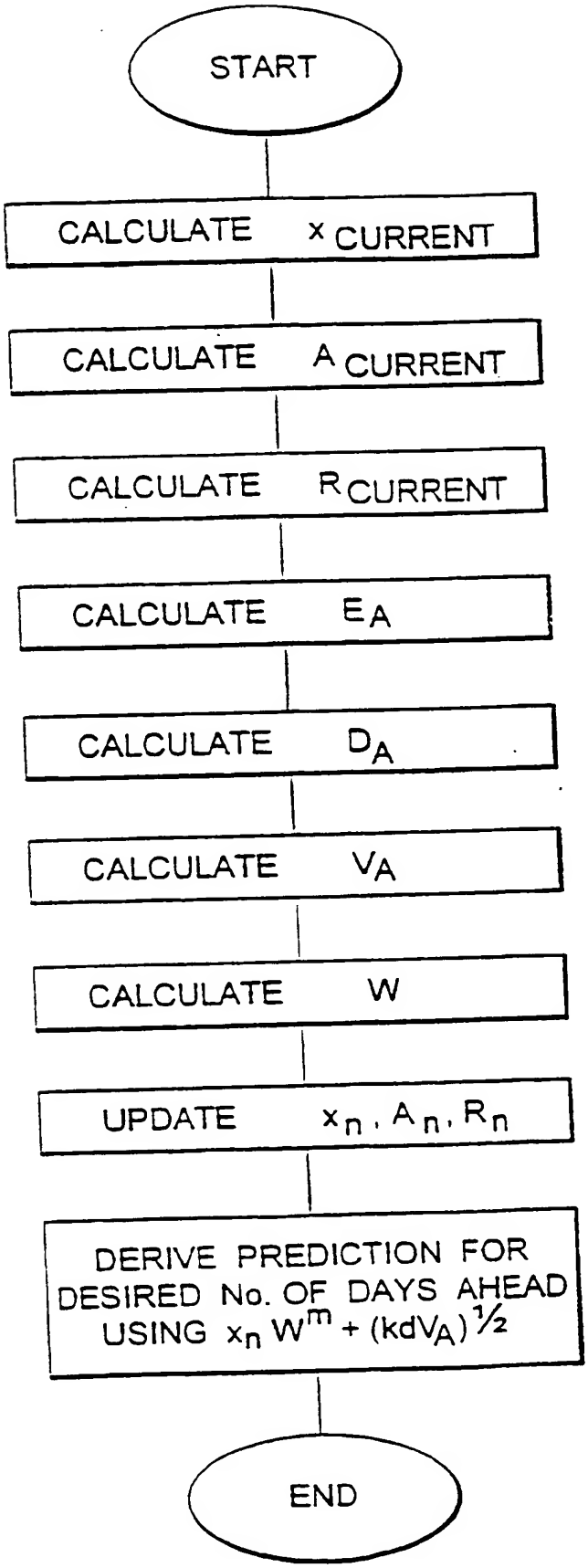


FIG.7



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(54) Currency handling apparatus

(57) A currency handling apparatus comprising a store for storing currency of a first denomination and signal generating means, wherein in response to a signal from the signal generating means the apparatus directs currency of a second denomination to the store.

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EUROPEAN SEARCH REPORT

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EP 00 11 6319

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Y A	* column 3, line 22 - line 60; figure 1 *	20,21 4,11,12, 17,18, 22,31,35	
Y	US 5 400 891 A (WINSTANLEY) 28 March 1995 (1995-03-28) * abstract; figures *	20,21	
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A	* column 4, line 46 - column 5, line 14; figures 1,2 *	11,12, 20-22,35	
A	EP 0 397 353 A (SANDEN) 14 November 1990 (1990-11-14) * column 4, line 32 - column 5, line 55; figures 2-4 *	1,5,7,8, 10,12, 14,16, 19, 23-28, 32,34,35	TECHNICAL FIELDS SEARCHED (Int.Cl.7) G07F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 November 2000	Neville, D

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